

CLAIMS

1. A solid oxide fuel cell comprising:

a plurality of electric power-generating elements stacked in a stack direction and each including a solid oxide electrolyte and a porous electrode section to which gases are supplied;

a plurality of first current collector layers, connected to the electrode sections, respectively, which are porous;

at least one separator disposed between at least one pair of adjacent ones among the plurality of electric power-generating elements to electrically connect the at least one pair of adjacent ones to one another such that the plurality of electric power-generating elements are electrically connected in the stack direction;

a gas supply flow channel defined between the at least one separator and associated one of the plurality of first current collector layers;

a plurality of gas supply branch flow passages branched off from the gas supply flow channel and reaching the electrode section of the associated one of the plurality of electric power-generating elements; and

a plurality of gas exhaust flow channels permitting a remnant of gas, provided to the associated one of the plurality of electric power-generating elements via the plurality of gas supply branch flow passages, to be exhausted through the associated one of the first current collector layers.

2. The solid oxide fuel cell according to claim 1, wherein the electrode section includes a porous oxidizer electrode formed on one surface of the solid oxide electrolyte to be supplied with oxidizer gas and a porous fuel electrode formed on the other surface of the solid oxide electrolyte to be supplied with fuel gas.

25 3. The solid oxide fuel cell according to claim 2, wherein the plurality of first current collector layers are disposed adjacent to the oxidizer electrode and the fuel electrode, respectively.

4. The solid oxide fuel cell according to claim 1, wherein the plurality of gas supply branch flow passages are branched off from the gas flow channel to reach the electrode section of the associated one of the plurality of electric

power-generating elements via the associated one of first current collector layers.

5. The solid oxide fuel cell according to claim 1, wherein the plurality of first current collector layers include porous electric conductors.

6. The solid oxide fuel cell according to claim 1, wherein the gas exhaust flow channels are formed on the plurality of first current collector layers, respectively, and have recesses, subjected to pore stop processing, which reach the electrode section of the associated one of the plurality of electric power generating section.

5 7. The solid oxide fuel cell according to claim 1, wherein second current collector layers, each composed of a porous electric conductor, are placed between the 10 plurality of electric power-generating elements and the plurality of first current collector layers, respectively.

15 8. The solid oxide fuel cell according to claim 7, wherein the remnant of gas provided to the associated one of the plurality of electric power-generating elements via the plurality of gas supply branch flow passages is exhausted via associated one of the second current collector layers.

9. The solid oxide fuel cell according to claim 1, wherein the number of the plurality of gas exhaust flow channels are larger in an outer peripheral area than that of the gas exhaust flow channels in a central area of the associated one of the plurality of electric power-generating elements.

20 10. The solid oxide fuel cell according to claim 1, wherein cross sectional areas of the plurality of gas exhaust flow channels are larger in an outer peripheral area than those of the gas exhaust flow channels in a central area of the associated one of the plurality of electric power-generating elements.

11. The solid oxide fuel cell according to claim 1, wherein the plurality of first 25 current collector layers include a frame section, formed with a plurality of openings, and porous electric current conductors correspondingly placed adjacent to the plurality of openings, and the gas supply flow channel are branched off at the plurality of openings.

12. The solid oxide fuel cell according to claim 11, wherein the frame section is 30 made of metal and a size of the plurality of openings is greater in an outer

peripheral area than that of the openings in a central area of the associated one of the plurality of electric power-generating elements.

13. The solid oxide fuel cell according to claim 11, wherein a width in which the frame section overlaps the porous electric conductor is greater than a thickness of the porous electric conductor in the stack direction.

14. The solid oxide fuel cell according to claim 1, wherein third current collector layers, each composed of a porous electric conductor, are placed in the plurality of gas exhaust flow channels, respectively, and the third current collector layers have a porosity greater than that of the plurality of first current collector layers.

10 15. The solid oxide fuel cell according to claim 7, wherein third current collector layers, each composed of a porous electric conductor, are placed in the plurality of gas exhaust flow channels, respectively, and the third current collector layers have a porosity greater than that of the second current collector layer.

16. The solid oxide fuel cell according to claim 2, wherein the plurality of first current collector layers each facing the fuel electrode carry fuel reforming catalyst.